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ABSTRACT

Common elements of definitions of competency-based vocational education (CBVE) are: (1) CBVE is an instructional process; (2) students must develop competencies; (3) competency includes skill, knowledge, and attitudes; and (4) the outcome is successful job performance. Advantages of CBVE include: (1) students' awareness of what is expected of them through use of performance objectives; (2) student involvement in the learning process by informing them of expectations; (3) enhanced student motivation through use of a variety of learning activities; (4) greater flexibility due to the individualized and self-paced approach; (5) accommodation of student differences through pacing and individualization; and (6) increased accountability for all involved. Disadvantages are initial time investment required of teachers and effort required to gain administrator and parent acceptance. Popular models for developing CBVE materials are the three methods of task analysis recognized by the Illinois CBVE Project (small group, research, and job observation), DACUM or Developing a Curriculum, and the Vocational-Technical Consortium of States (V-TECS). State initiatives relating to CBVE in Indiana are being undertaken by the Indiana Commission on Vocational and Technical Education, the Indiana Department of Education, the Commission on Higher Education, and the Indiana Department of Employment and Training Services. Several secondary vocational programs also have CBVE curricula in place. (Eleven endnotes are provided.) (YLB)

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Answering the Demands of a New Workplace: Using Competency-Based Vocational Education to Prepare Workers

The impetus for competency-based vocational education

Although the concept of competency-based vocational education (CBVE) is not new, it has recently enjoyed a resurgence of attention. Undoubtedly, this is due, at least in part, to employers' desire to more hire qualified workers in order to survive in our ever more competitive marketplace. Employers look to vocational education as one source of these workers. When evaluating prospective workers, employers want to know what skills (i.e., competencies) a worker possesses. This type of inquiry has prompted many vocational schools to provide students with a list of acquired competencies with their diploma or certificate of completion. The renewed interest in CBVE also is due to the mandates presented in Indiana's Public Law 217-1987 (P.L. 217). P.L. 217 establishes the technology preparation task force, whose purpose is to design and approve technology preparation curriculum models. The purpose of technology preparation (tech prep) is to enhance student potential for success in a technologically intense world. The law states that curriculum models developed by the task force must be performance-based. (1)

Not only is the [Indiana] state legislature providing impetus for CBVE but so is the United States Congress. The Carl D. Perkins Vocational Education Act of 1984 currently is undergoing reauthorization. As part of the reauthorization plan,

a two-year process of forming performance measures is being proposed. These performance measures would evaluate coordination, counseling, and competency factors. (2)

In looking to the future of vocational education in Indiana and the need to meet these legal mandates, the Indiana Commission on Vocational and Technical Education (ICVTE), in its long-range state plan, lists "plan and develop guidelines for competency-based education for vocational education as defined under Public Law 217" as one strategy for addressing state needs. (3)

The purpose of this paper is to define competency-based vocational education and discuss its advantages and disadvantages; to describe popular models for developing CBVE materials; and to describe some of the current practices in CBVE in Indiana.

CBVE defined

Competency-based vocational education (CBVE) is defined by the Maryland State Department of Education as follows:

> an instructional process aimed at improving the teaching-learning process. ... CBVE refers to occupational programs in which required behaviors (competencies) and performance standards are specified in advance of instruction. ... The basic intent of CBVE is to aid student achievement of required behaviors or competencies needed for successful on-the-job performance. (4)

CBVE may also be called performance-based vocational education (PBVE), mastery learning, or criterion-referenced instruction. Regardless of the name, students are required to learn behaviors that are stated as competencies. Learning

usually takes place in both the classroom and in practical or on-the-job settings. The Maryland State Department of Education defines a competency as "the ability (including knowledges, skills, and/or attitudes) to perform a specific task successfully to meet a specified performance standard." (5)

> A similar definition of CBVE is offered by Pennsylvania:
> an instructional system based on occupational analysis and clearly stated performance objectives that lead to the development of competencies -- knowledge, skills and attitudes -- that are deemed critical to successful employment in work environments. (6)

Four common elements emerge from these two definitions of CBVE: (1) CBVE is an instructional process, (2) students must develop competencies, (3) competency includes more than skill -- it also includes knowledge and attitudes, and (4) the outcome is successful job performance.

In fact, the following list of essential elements or characteristics of CBVE is derived from a review of material from the Maryland State Department of Education, the Pennsylvania Department of Education, and the National Center for Research in Vocational Education:

1.) Content is based upon actual workers' tasks, i.e., occupational analysis (job and task analysis).

2.) Student performance objectives are derived from the task lists and standards of performance derived during occupational analysis and are specified in advance of instruction.

3.) Student achievement is based upon demonstrating acquisition of competency. The criteria used for assessing competency and the conditions under which the assessment will occur are stated explicitly and in advance of instruction.

4.) Instruction is individualized with learning time flexible and self-paced.

5.) Feedback is an important part of CBVE. Feedback is immediate at best or frequent at least.

6.) A program of open entry/open exit is possible. At the very least, emphasis is placed on exit standards or what the learner has achieved. This does not mean that entry requirements are ignored. On the contrary, entry requirements allow students to provide evidence of and receive credit for previously achieved competencies.

These characteristics of CBVE are depicted in contrast to traditional learning environments in Table 1 displayed on page 5.

Advantages of CBVE

The advantages of CBVE may be summarized as follows:

1.) students' ability to learn is enhanced through the use of performance objectives to inform students of what they must do and how well it must be done;

2.) students' involvement in the learning process is increased by informing them in advance of instruction of the expectations they must meet;

Table 1

CBVE vs. Traditional Learning Environments

CBVE vs. Traditional	
CBVE	Traditional
1. The main indicator of student achievement is ability to effectively and efficiently perform a job.	1. The main indicators of student achievement are knowledge of subject and ability to tell how to effectively and efficiently do the job.
2. Time is not a prime factor. Once students demonstrate ability to do a job, they may do it. Students may finish before others or take longer than others.	2. Time is a factor. Student must adhere to time frame such as academic year or semester; requirements of clock hours of instruction are usually adhered to.
3. Criterion of success is demonstrating ability to do the job.	3. Criterion of success is grades.
4. Exit standards rather than entrance requirements are emphasized. The students are accepted at their own level; instruction is designed accordingly.	4. Entrance requirements important. Must meet these to be admitted to the program.
5. Flexible scheduling of learning activities.	5. Instruction is scheduled into fairly rigid blocks of time.
6. Opportunity to acquire competencies on the job or in practical situations.	6. Limited practical field experiences.

3.) student motivation is enhanced by using a variety of learning activities;

4.) students and teachers have a greater degree of flexibility due to the individualized and self-paced approach;

5.) student differences are accommodated through pacing and individualization;

6.) student motivation to learn is increased because the competencies are relevant to the desired occupation; and

7.) accountability is increased for students, teachers, administrators, parents, and employers because programs are based on specific competencies and because the student and teacher are managers and facilitators of the learning process.

Disadvantages of CBVE

The major disadvantage of the competency-based approach is the time investment required for teachers to initially set up this type of program. In deciding to individualize instruction, provide a self-pace, and determine competencies, teachers may have to revamp lesson plans. In addition, employers may need to be visited to determine appropriate competencies to be included in a specific program or the appropriate sequence of teaching the identified competencies. A word of hope -- advisory committees may be helpful in identifying and sequencing competencies. In

fact, the advisory committee may be able to help the teacher make a smooth transition to a CBVE system.

A second disadvantage to the CBVE approach may be in the effort that might be required to help administrators and parents accept this type of learning environment. Use of this approach requires a different way of viewing the teaching-learning process. Persons might be skeptical, believing that this approach is less rigorous or acceptable. Some of their common misconceptions include lowered academic standards because too many students get A's; students know what will be on the tests (i.e., teachers are teaching to the test); all students are forced into the same mold; and students may become isolated in this type of instructional process.

The Maryland State Department of Education offers the following responses to these misconceptions:

While grades on the whole may be higher in a CBVE approach, the standards for achieving them are raised, not lowered. Because students no longer must compete with one another but rather with a standard known to them, motivation and achievement are increased.

Teachers do not teach for specific items on a given test but rather for the skills (including knowledge and attitudes) that are required on the test. Criterion-referenced evaluation pinpoints the essential elements of learning, freeing both the teacher and student from trying to outguess each other about the minutia or nonessentials of learning.

While it is true that all students are required to learn the same basic or minimum competencies, once these are mastered students may choose to specialize or refine particular job skills. Is this so different from more traditional methods of instruction?

Individualized instruction does not necessarily mean isolated instruction. Individualized instruction may provide the student with more opportunity to interact with peers and teachers. This type of instruction is a valid and accepted method of instruction. (7)

Perhaps a word about criterion-referenced evaluation should be interjected. This type of testing/evaluation is the preferred evaluation method when using a CBVE system. As the name implies, this type of evaluation refers to comparing a student's performance to a standard (or criterion) rather than to other students in a group as is the case with norm-referenced evaluation. This type of evaluation is an accepted method of evaluation. The characteristics of criterion-referenced evaluation parallel those of CBVE as follows:

(1) instructional objectives must be clearly defined and stated in behavioral or performance terms;

(2) the standards of performance must be specified clearly;

(3) student performance must be sampled adequately within each performance area;

(4) the scoring and reporting system should describe adequately the student's performance on learning tasks that are defined clearly.

A brief comparison of criterion-referenced evaluation and norm-referenced evaluation appears in Table 2 on page 10.

Managing a CBVE system

How does an instructor manage a CBVE system? Flexibility and planning are the keys to managing a classroom or program utilizing the CBVE approach. The instructor must become a "manager" or "facilitator" of instruction rather than a lecturer or "giver of information." The instructor will spend most of the time giving demonstrations, assigning various tasks to students, providing individual and group assistance, and evaluating student progress. This does not mean that instructors will not continue to use traditional methods such as lectures. They will do so but less often and only when it is the most effective method of instruction for the topic being presented.

The students will have increased independence and therefore responsibility in this type of learning environment. Students must be provided an orientation to this method so that they will be able to obtain, use, care for, and store or replace materials, equipment and supplies.

Perhaps the greatest change and management decision is the monitoring system. The instructor will develop a system that

Table 2

Criterion-Referenced (CBE) vs. Norm-Referenced Evaluation (NRE)

CRE vs. NRE

CRE	NRE
1. Students are compared against a standard or criterion.	1. Students are compared against each other (i.e., the normal curve).
2. Test items must be selected relative to how well specified behavior is measured.	2. Anything discussed, read, presented or reviewed is a potential test item.
3. Scoring and reporting are descriptive of student performance.	3. Scoring and reporting vary greatly.

works best for the occupational area being taught and the school system. Some possible methods include the following:

(1) Use bulletin boards with all of the competencies to be learned across the top, the students' names down the left side. When competencies are learned, appropriate checks may be made.

(2) Keep a supply of competency sheets for each competency to be mastered in a central location. Ask each student to maintain an individual file of completed competency sheets.

(3) Distribute competency sheets for each of the competencies to be learned in a given session. Ask the student to maintain a personal file of these sheets and the completed competency sheets. (8)

Other methods may be used to manage a CBVE system. Like the instruction, management is individualized to fit the needs of the instructor and the students. The important thing for instructors and administrators considering this system is to avoid being "scared away" by the apparent paperwork burden. As in any rookie season, the road ahead at first looks long and arduous. However, once the initial work is complete, it can be well worth the effort. Like any quality instruction, it takes care and attention.

Models for developing CBVE materials

The core of CBVE systems is the use of occupational analysis to derive a list of tasks or competencies to be taught. The occupational task analysis is a process of reviewing the occupation or job to determine the tasks that encompass the job; the steps necessary to perform each task within the job; the related knowledge and attitudes required to perform each task; any decisions or cues involved in performing each task; the tools, equipment, and materials needed to perform each task; any safety factors (to oneself and to others) involved in performing the task; and the standard necessary when performing each task. It is not necessary to "start from scratch." To determine if task lists already exist for the particular occupational area, a curriculum center such as Vocational Education Services (VES) could be called. If task lists do exist, review them to determine currency and relevancy to the individual program. Again, use the advisory committee to help in the review of task lists.

The Illinois CBVE Project recognizes three methods of task analysis: small group, research and job observation. (9)

The small group method involves the use of three to five persons considered technical experts in the occupation, one facilitator and one recorder. The facilitator should be trained in task analysis procedures. In this method, neither the facilitator nor the recorder has technical expertise in the

occupation being analyzed. The group meets to review task lists, modifying the list of tasks as well as the analysis of each task, as needed. Modifications include adding or deleting tasks, modifying the steps required to complete the task (i.e., due to new equipment, changes in standards accepted by the field, etc.), adding safety information, adding or changing information regarding the tools or equipment required to complete the task(s), etc. The facilitator should use key questions to assist in reviewing each task. The advantages of this method include the use of a variety of experts from whom state-of-the-art information is gathered and the active involvement and participation of business and industry. The disadvantages of this method include the high cost (including materials, meeting room, meals, honorarium, and lodging, depending on the length of the meeting), the possibility that one or two members of the group may monopolize the discussion, the difficulty of getting a good cross section of technical experts, and conducting the analysis away from actual occupational sites. While experts know their occupations, hearing them described is not as useful as seeing the occupation firsthand. Even if this is the method of task analysis used, it is recommended that an instructor who is going to teach the occupation using a CBVE approach visit one or two occupational sites.

Use of the small group method is appropriate when dealing with new and emerging technologies, when updating existing curricula or resources, when time is a critical factor in

completing the analysis, and when the instructor desires an industry overview or composite.

The research method involves a group of technical experts and one facilitator who has been trained in task analysis procedures and has technical expertise in the occupation being studied. The group meets to review the task lists and analysis of each task, as above. Modifications to the task analysis are made as needed. The advantages of this method include the active involvement of technical experts and because the facilitator also has technical expertise, the process may flow more quickly and easily. The disadvantages of this method include the potential cost and time involved in locating up-to-date resources. The research method is appropriate when analyzing established occupations and time is not a critical factor.

The job observation method of task analysis involves one or more persons trained in task analysis procedures and curriculum development, skilled workers on an occupational site to be observed, and technical experts to verify the completed task analysis. This method involves the task analyzer visiting the job site, observing skilled workers performing the job, and questioning the workers about the steps, decisions, safety factors and equipment involved. Once the task analysis is complete, the analyzer verifies the completed analysis through technical experts or revisiting the job site and asking the observed workers to review the analysis. The advantages of this method include the accuracy in detail, the direct involvement

with business and industry, and it is most representative of worker skills. The disadvantages of this method include the amount of time required, particularly in arranging the visits. Also because workers will be at least minimally distracted (by the questions), employers may be hesitant to participate. When arranging the site visit, it is important to explain the process completely, including why the process is necessary. In addition, the analysis may be site specific and it may be difficult to arrange a visit that fits the schedule of all participating parties.

The job observation method is appropriate when no or few materials exist about an occupation, for new and emerging occupations, when detail is needed, or for developing training that is site specific.

The job observation method is preferred due to the detail afforded and the relationships that can be established with business and industry. However, it is not always possible to use this method. If possible, a combination of the three methods could be used.

Developing A Curriculum (DACUM)

Another recognized method of task analysis is DACUM or Developing A Curriculum. This approach was developed by the Humber College of Applied Arts and Technology in Ontario, Canada. DACUM is "a process of job or occupational analysis which determines the skill requirements for a particular job or related

job family. These skills and tasks become the basis for the units of instruction in the program." (10)

The DACUM process involves a meeting of a technical committee of 8-10 persons meeting for three consecutive days. Persons who have received special DACUM training act as the facilitator and recorder. The persons on the committee should represent the entire occupation or specialty being considered and should be persons who are working in the occupation. The committee members should be considered competent by their associates and must be free to meet for the required three days. The developers of the DACUM process recommend that educators not be part of the committee because of the potential bias in training methods, costs, status, and qualifications that they may bring to the process. For example, educators may feel that the best method to learn a particular skill is to have the student shadow a worker whereas the committee member may feel that actually having the student perform the task (with supervision) is the best method. Educators may feel that it is too costly to take a class of students to a plant for an orientation session to a new machine whereas the committee member may feel that this orientation is important for the students. Educators may feel that having workers on a committee that is making curricular recommendations is not appropriate because the workers do not have the same status and qualifications as professional educators and supervisors. This is not the case. The workers are the

richest source of information about the job and should not be placed in potential embarrassing or awkward positions.

The DACUM facilitator explains the process to the committee and provides examples of completed DACUM charts. The committee begins by delineating the general job or skill area being studied and the major job functions of persons performing the job. Next, individual skills required for the job are identified. Each of these general skill areas and the corresponding individual skills are placed on three-by-five cards and placed on the wall for the committee to review. Each skill area and its individual skills are called a "band." Each band is reviewed and sequenced in the order that it would be met or required on the job. In addition, the skills areas (vertical row of cards) also are sequenced. The sequencing is done to demonstrate the fact that a worker may require one skill before performing another. The individual skills are rated for difficulty and frequency of performance. The result is a DACUM chart for the occupation.

The advantage of this method is the use of workers currently performing the job because they are best able to describe the job in the appropriate vocabulary as well as describe the difficulties in learning the job. The workers can best help in deciding the sequence for teaching the job tasks as well as the related information (i.e., safety) that should be included in the instruction. The disadvantage of this method is the necessity to use trained DACUM facilitators, meaning costs may be high. Other costs may include meals, honoraria if paid, meeting room costs,

lodging, etc. This method is appropriate when reviewing and updating existing curriculum.

V-TECS

Another resource to be considered in developing CBVE materials is the Vocational-Technical Consortium of States (V-TECS). V-TECS is a group of states and interested agencies (such as the training commands of all branches of the armed forces and the U.S. Department of Corrections) that develop performance-based curriculum materials and disseminate these materials to both member and non-member states. Full member states develop two products per year. These products include a catalog of duties and tasks derived from an occupational task analysis; a curriculum guide derived from the catalog but including student activities, teacher resources, etc; or a criterion-referenced test bank, a bank of performance and written test items related to the occupation. V-TECS provides personnel from each member state with training in its product development model, and persons from the central office are available for technical assistance. Advantages of this method include the use of worker-validated materials and the resources provided by the members of the consortium. Disadvantages of the method include the cost of membership and product development. The membership fee for a full-member state is $20,000. The costs of developing the two products required to fulfill membership obligations varies from $20,000 to $50,000. The cost depends on the type of product (catalog, curriculum guide, test bank) developed. (States may

purchase materials developed without joining the consortium. In addition, materials may be borrowed from curriculum centers such as Vocational Education Services.) This method is appropriate to use when updating and revising CBVE materials and for new and emerging occupations.

CBVE practices in Indiana: state initiatives

In Indiana, several state agencies share responsibility for vocational education programs and delivery. The primary agencies involved include the Indiana Commission on Vocational and Technical Education (ICVTE), the Indiana Department of Education, the Commission on Higher Education, and the Indiana Department of Employment and Training Services (IDETS).

As indicated in the introduction to this paper, the ICVTE plans to develop guidelines for competency-based education for vocational education in Indiana. In addition, the ICVTE has provided funds for membership in the V-TECS consortium.

In the Biennial Plan for Secondary and Adult Vocational Education, the Indiana Department of Education lists several initiatives for 1989-1991, including (1) develop and adopt proficiencies for vocational education, (2) develop and implement new technology based curricula, and (3) increase articulation and coordination of secondary and postsecondary curricula. For each of these initiatives, the plan also lists strategies for implementation. The CBVE method may be a useful tool for assisting in the implementation of these strategies. (11)

In addition, representatives from ICVTE and the Department of Education have participated in the technology preparation task force. Several pilot sites have been identified for the technology preparation curriculum.

The Commission on Higher Education (CHE) will be working with the Department of Education to carry out its strategies for articulation and coordination of secondary and postsecondary curricula. The CHE provides for much local control, i.e., the individual institutions and programs make decisions about the methodology used within that institution or program. Many postsecondary programs in Indiana do utilize a CBVE approach, but again, this is a local decision.

IDETS, through the Job Training Partnership Act (JTPA), already has established competencies. These are used to measure positive terminations from the program. While not strictly a CBVE system, it is similar. JTPA currently is undergoing review by the U.S. congress. One area being examined is this area of competencies.

CBVE practices in Indiana: local initiatives

Several secondary vocational programs have CBVE curricula in place. The Columbus Area Vocational Program used a three-phase process to initiate CBVE. The first phase of the project involved collecting and/or compiling a duty and task list for 54 programs. Existing lists were reviewed and other schools were contacted in this process. The task lists for the 54 programs were each reviewed by advisory committees and content experts in

the community. The second phase of the project involved the completion of 33 CBVE curricula. Each includes the performance objectives, task analysis guide, and criterion-referenced measure. The students in each of these programs receive a "Passport to Employment," which lists the competencies achieved. The third (and current) phase involves six teachers developing test banks in four of the programs already completing phases 1 and 2. The test banks are keyed to the duties and tasks and contain approximately 350 questions per program.

The Wayne Township Area Vocational School has used the same type of process for developing CBVE curricula for its programs. In addition, the school offers one day training sessions for teachers from other schools.

New Educational Directions, in conjunction with Wayne Township Area Vocational School, has undertaken a competency-based training program for the Department of Corrections.

The Hoosier Hills Area Vocational School has been converting all program areas to a CBVE format. The teachers have attended various training sessions including the course in curriculum development offered by Indiana State University (described below), the Mid-American Conference on Competency-Based Education, and V-TECS inservice sessions. Currently, about one third of the programs are CBVE; others are being converted. In addition, this school is one of the pilot sites for the tech prep curriculum.

At the postsecondary level, Vincennes University sent eight of its faculty members to VES for training in the development of CBVE materials. The training included a two-day workshop in Bloomington and an on-site follow-up visit to each faculty member in Vincennes.

Indiana State University offers a three-hour course in the development of competency-based vocational education materials. This course may be taken for undergraduate or graduate credit. The course covers the characteristics of CBVE, task analysis procedures, developing CBVE materials, evaluating students in a CBVE system, and managing a CBVE classroom system.

Conclusion

The CBVE approach is not a panacea that will cure vocational education's woes. It is offered as one approach that is viable, accepted, and appropriate in vocational education settings, at all levels. The key to successfully implementing a CBVE approach is to provide support to those who most need it and to allow for time and mistakes as the developmental process occurs.

Any new venture has risks, but frequently the rewards and outcomes far outweigh those risks.

Endnotes

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2) Vocational Training News, "House Reauthorization Plan Seeks 'Major Refocusing' for Voc Ed." April, 13, 1989. Vol. 20, No. 15, pp. 1-4.

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4) What is Competency-Based Vocational Education (CBVE)? Maryland State Department of Education, Division of Vocational-Technical Education, 1978.

5) Ibid.

6) A Study to Assess the Impact of Competency-Based Vocational Education in Pennsylvania (Phase 1). Pennsylvania Department of Education, 1984.

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9) "Task Analysis: The Bridge Between Worker-Verified Tasks and Instructional Materials." Developed by the Illinois CBVE Project Staff. August 19, 1986.

10) Embree, R. and Hart, J. (no date). "DACUM: Developing A Curriculum." Humber College of Applied Arts and Technology, Rexdale, Ontario, Canada.

11) Indiana State Board of Education's Biennial Plan for Secondary and Adult Vocational Education. July 1, 1989-June 30, 1991.